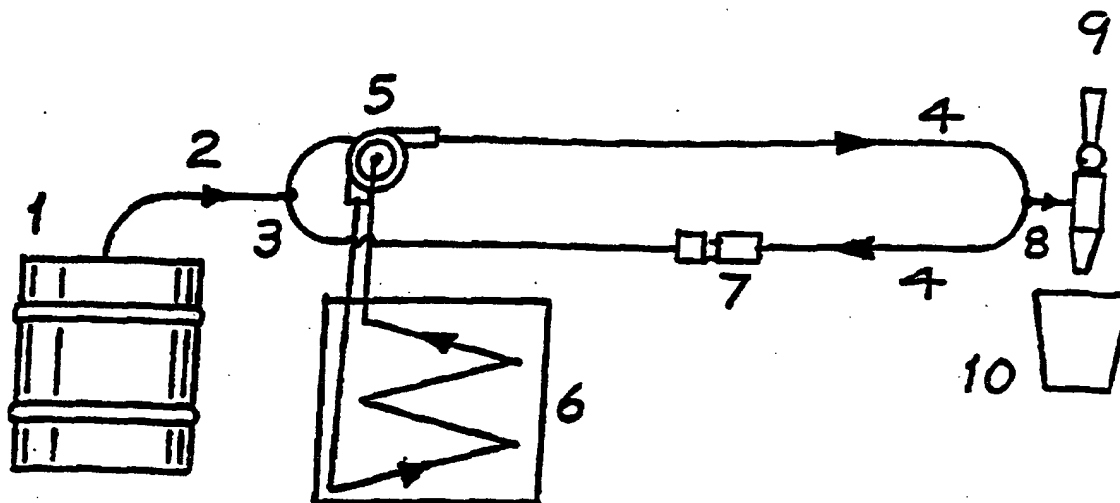


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(21) International Application Number: PCT/GB97/00288 (22) International Filing Date: 3 February 1997 (03.02.97) (30) Priority Data: 9601994.8 1 February 1996 (01.02.96) GB (71)(72) Applicants and Inventors: LEEMING, Douglas, Richard [GB/GB]; Hillcrest House, 140 Langer Lane, Chesterfield S40 2JJ (GB). BROWN, Brian, John, Colin [GB/GB]; 53 Pantheon Road, Chandlers Ford, Eastleigh, Hampshire SO53 2PD (GB). (74) Agent: LUNT, M., G., F.; Dibb Lupton Alsop, Fountain Precinct, Balm Green, Sheffield S1 1RZ (GB).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: LIQUID TEMPERATURE REGULATING APPARATUS**(57) Abstract**

The liquid temperature apparatus (6) is used in a beverage dispensing system comprising a beverage storage container (1) connected via a liquid feed tube (2) to a liquid dispense tap (9). The liquid feed tube is divided by Tee piece (3) and connected to a pair of circulation tubes (4). A pump means (5) circulates the beverage around the tubes, and also around the coil of the cooling unit (6). The fluid flow rate is controlled by the adjustable fluid control device (7).

Liquid temperature regulating apparatus

This invention relates to liquid temperature
5 regulating apparatus, and more particularly to a liquid
temperature regulating apparatus and method suitable for
use in beverage dispensing devices whereby potable
liquids are dispensed at pre-determined temperatures.

10 In the beverage dispensing industry, when beverages
are not dispensed directly from the container, a system
of pipe work or tubing is used to transfer the product
from its bulk storage area to a convenient point of
service. Such dispense tubes, pipes or lines are used
15 today extensively for the serving of beers, ciders, soft
drinks and other beverages in public houses, bars and
other licensed premises.

The pipework or tubing was originally formed from,
20 for example, a variety of metals, rubber, glass and
ceramics materials. With the advent of modern hygienic
flexible plastics tubing and pipework, the installation
of the pipework or tubing has become simplified.

25 Customer demand over recent years has led to the
development of various methods of cooling the products to
suit various tastes and climatic conditions. Wherever

possible, bulk potable liquids are stored at near ideal drinking temperatures, but problems still arise during the movement of the potable liquids from a cool storage area to a dispensing point, because of undesirable
5 temperatures rises of the liquid in the dispense tube, pipe or line.

In the prior art, two methods of dealing with this problem have been adopted:

- 10 (i) In the first method, a "flash" cooler is mounted as close as possible to the point of dispense. As the beverage is drawn off through, for example, a tap or faucet, it is introduced into a metal tubular coil immersed in a bath of refrigerated liquid. It is,
15 however, difficult to maintain a constant temperature, because, should the beverage remain in the coil for long periods, it will be below the recommended temperature, and on rapid constant delivery, the coil has difficulty in liberating
20 sufficient heat from the beverage. A further undesirable feature of the flash cooler is that the refrigerator apparatus gives off copious amounts of heat in and around the servery which is uncomfortable for the staff of the premises in
25 certain climatic conditions.

(ii) In the second method, a "python" line chilling device extending from the cool storage area to close to the point of dispense is used. The python device consists of several product delivery tubes or pipes encapsulated together with two larger diameter flexible tubes, one for flow and the other for return, the whole being wrapped with an insulating material to prevent heat ingress. The flow and return tubes constantly circulate a coolant fluid, usually water, from a remotely mounted refrigerated cooler. Although temperature control is more readily maintained in comparison with the flash cooling method, after a time, even those product lines furthest away from the flow and return tubes become too cold, rendering cask conditioned beers flat, leading to unattractive presentation, loss of vital flavours and lack of detection of high temperature vaporising odours. The recently introduced range of "ice" beers, which are served at very low temperatures, compounds the problem even further. In addition, the inflexibility, size and bulk of the python lines make their installation difficult and time consuming. The python system, containing as it usually does, a variety of product lines that ideally should be served at differing temperatures, has the further disadvantage that, the correct dispense temperature of various and varying

beverages cannot always be maintained to the manufacturer's preferred recommended temperature.

It will be appreciated that there is a need for
5 an improved apparatus and method for controlling and monitoring the temperature of beverages within dispense tubes, pipes or lines.

The present invention provides a liquid temperature
10 regulating apparatus and method suitable for use in beverage dispensing systems wherein the liquid to be dispensed is brought into contact with a liquid temperature regulating means independently of the dispensing means.

15

The invention further provides a liquid temperature regulating apparatus a method suitable for use in beverage dispensing systems wherein the apparatus comprises a dispensing system having a liquid
20 recirculation circuit therein incorporating a liquid temperature regulating means.

In a first aspect, the invention provides a liquid temperature regulating apparatus suitable for use in a
25 beverage dispensing system comprising a liquid storage means and a dispensing means which comprises:

- (i) a liquid dispense tube, pipe or line extending from the liquid storage means to the dispensing means;
- (ii) a liquid temperature regulating means; and
- (iii) means for circulating the liquid in the liquid dispense tube pipe or line independently of the dispensing means into contact with the liquid temperature regulating means.

In a further aspect the invention provides a method of regulating the temperature of a liquid to be dispensed which comprises circulating the liquid into contact with a liquid temperature regulating means independently of the dispensing means.

In conventional cooling systems, yeast deposits often build up in the tubes carrying the potable liquid from bulk storage to the point of dispense. Typically, beverage cooling systems comprise a refrigerated bulk storage and a possible solution to regulation of the temperature of the potable liquid is to recirculate via the refrigerated bulk storage. However, such a solution is neither hygienic nor, in many jurisdictions, legal.

Accordingly, an embodiment of the present invention provides a potable liquid temperature regulating apparatus as claimed in any preceding claim, wherein the potable liquid is brought into contact with the liquid

temperature regulating means without being returned to bulk of the potable liquid.

The liquid temperature regulating apparatus of the invention is suitable for use with any appropriate beverage dispensing system, but is particularly useful in the dispensing of beverages which need to be served at or below ambient temperatures, particularly below 15°C, and especially from 0 to 13°C, for example, from about 8 to 12°C.

The invention is applicable to the dispensing of a wide range of beverages, for example beers, lagers, ciders, wines and soft drinks. The invention is, however, particularly suitable for use in the dispensing of beers and lagers, where temperature control at the point of delivery is particularly important.

The liquid storage means can be any of those conventionally used, and will normally comprise a keg, barrel, or other storage container, situated remotely from the dispensing means in a cellar or storeroom.

The dispensing means can comprise, for example, a tap or faucet, a beer pump, or any similar such device.

The liquid dispense tube, pipe, or line extends from the liquid storage means to the dispensing means, and can comprise, for example, one or more such tubes, pipes, or lines made from, for example, a suitable flexible
5 plastics material.

In a preferred embodiment of the invention, the liquid dispense tube, pipe, or line comprises two such tubes, pipes, or lines located within an outer insulated
10 jacket formed from, for example, a suitable foam material. Preferably the two tubes, pipes, or lines are connected at their ends, for example, by Y- or Tee piece connectors so that they run in parallel for at least a part of the tube, pipe, or line extending from the liquid
15 storage means to the liquid dispensing means. The two tubes are arranged to provide flow and return beverage paths in to order to facilitate circulation of the beverage. However, the flow and return paths can equally well be realised using a single tube with appropriate
20 taps being taken therefrom to allow dispensing of the potable liquid.

The liquid temperature regulating means can comprise, for example, a cooling means which can be a
25 conventional beverage cooler having a reservoir of cooling fluid and one or more cooling coils within which one or more beverages can flow. Preferably, however, the

liquid temperature regulating means comprises a cooler provided with a plurality of cooler compartments arranged at different temperatures or provided with a single cooling compartment having a temperature gradient, so
5 that beverages in a plurality of different cooling coils are exposed to different temperatures in the cooler.

The cooler can be connected to one or more of the liquid dispense tubes, pipes, or lines in series or in
10 parallel, as appropriate.

The means for circulating the liquid independently of the dispensing means can comprise, for example, a pump means which can be connected into the liquid dispense
15 tube, pipe or line in order to circulate the liquid into contact with the liquid temperature regulating means independently of the opening of the dispensing means. A portion of the liquid dispense tube, pipe or line can, for example, comprise a loop of two such tubes, pipes or
20 lines, one acting as a flow and the other as a return. Thus when the dispensing means is closed, the liquid can be circulated and re-circulated around the loop by the pump means, into contact with the liquid temperature regulating means, and thereby be maintained at a
25 substantially constant temperature. The temperature of the liquid will be dependent upon the temperature of the liquid temperature regulating means, the residence time

of the liquid in contact with the liquid temperature regulating means, and the liquid flow rate. The liquid flow rate may be regulated by altering the speed of the pump means or by the use of a flow control device.

5

It is important not to leave stagnant areas in the circuit, and appropriate flow control and equalising devices can be provided as necessary.

10 Preferably the liquid temperature regulating means is connected in parallel with the pump means.

Preferably, once the liquid dispensing means is operated, the liquid in the dispense tubes, pipes or
15 lines flows and allows the liquid to be dispensed, At the same time, further liquid beverage from the bulk container enters the liquid dispense tubes, pipes or lines, and, on closure of the dispensing means the circulation of liquid beverage around the system can
20 continue. Preferably the pump means is of the type whose action can be over-ridden by the liquid dispense flow. Alternatively the pump means can be provided with an override valve, or bypass, or the like.

25 Any number of liquid dispense tubes, pipes or lines can be used as desired, and any suitable configurations for re-circulation flow and return can be provided as

required. The invention allows the possibility of using liquid dispense tubes, pipes or lines of a much smaller diameter than those usually employed.

5 In preferred embodiment in the invention, there may be provided a beverage dispensing apparatus comprising a liquid temperature regulating apparatus wherein the beverage dispense tube, pipe or line comprises a twin flow and return tube suitably lagged or thermally
10 insulated, a Y- or Tee piece connecting the tubes at the point of dispense, and a further Y- or Tee piece connecting the tubes at a convenient distance from the bulk container. A pump is connected in series with one of the twin tubes in order to circulate and re-circulate
15 the beverage around the system and into contact with a refrigerated unit which is connected in parallel with the pump. The flow of the beverage in this circulating system can be controlled by the speed of the pump. Preferably a fluid flow control valve is used in order to
20 equalise to some extent the flow through the tubes when the dispense valve is opened. Depending on the type of pump used, it may not be necessary to stop the circulating pump during dispensing. On closing the dispense valve, the flow stops, and commencement of re-
25 circulation occurs, maintaining a constant temperature of the beverage within the dispense tubes.

The invention provides the opportunity to obtain the optimum dispense temperature for any particular beverage product. In addition, the continuous re-circulation action can also have the effect of scrubbing the internal
5 walls of the beverage dispense tubes, pipes or lines, thus reducing the opportunity for yeast deposits to form. By dramatically reducing yeast growth within the dispense tubes, pipes or lines, product presentation is improved and costly ullage is reduced.

10

An embodiment of a liquid temperature regulating apparatus of the invention will now be more particularly described, by way of example only, with reference to the accompanying Drawings in which:

15 Figure 1 shows a schematic view of a beverage dispensing system comprising a liquid temperature regulating apparatus according to the invention, with the dispensing valve in its closed position;

Figure 2 shows a schematic view of the system of
20 figure 1 with the dispensing valve in its open position;

Figure 3 shows a schematic view of an embodiment of the present invention comprising implemented in a ring main arrangement;

Figure 4 shows a schematic embodiment for regulating
25 the temperature of a plurality of potable liquids;

Figure 5 shows schematically an embodiment in which the plurality of tubes are grouped together;

Figure 6 shows an alternative grouping of the beverage tubes; and

Figure 7 shows a schematic embodiment in which the two refrigeration units of figure of figure 3 are
5 combined into a single unit.

Referring firstly to Figure 1, there is illustrated a beverage storage container 1 connected via a liquid feed tube 2 to a liquid dispense tap 9. The liquid feed
10 tube 2 is divided by Tee piece 3 and connected to a pair of circulation tubes 4. A pump means 5 circulates the beverage around the tubes 4, and also around the coil of the cooling unit 6, as illustrated by the arrows in figure 1. The fluid flow rate is controlled by the
15 adjustable fluid control device 7.

The re-circulation tubes 4 are connected to a second Tee piece 8 which leads to the dispense tap 9.

20 It should be emphasised that, with the dispense tap 9 in its closed position, no flow from the container 1 takes place, as the feed to the Tee piece 3 and the liquid in tubes 4 are under equal pressure. Whilst the dispense tap 9 is closed, the pump 5 continues to
25 circulate and re-circulate the beverage around the tubes 4, and around the cooling coil of the cooling unit 6,

thus maintaining the manufacturer's recommended dispense temperature.

Referring now to figure 2, there is shown the
5 situation when the dispense tap 9 is opened and beverage flows into the receptacle 10.

It can be seen that when the tap 9 is open beverage flows along the feed line 2, and along the re-circulating
10 tubes 4, through the second Tee piece 8 and into the dispense tap 9. Although not essential, it may be preferable to provide some means to override the pump 5 when dispensing the beverage through the dispense tap 9.

15 With reference to figure 3, an embodiment is shown in which the beverage or potable liquid container 1 is connected via a liquid feed tube 2 to a refrigeration or cooling unit 6. A ring main comprising a pump 5 and a plurality of dispense taps is provided for distribution
20 of the beverage. The ring main also comprises a further cooling unit 6 for use in regulating the temperature of the beverage contained within the ring main.

The first cooling unit is typically remote from the
25 point of dispense and is often a glycol based refrigeration unit having a very high cooling capacity. Therefore, the liquid leaving the first refrigeration

unit is always at a desired temperature. During periods of high demand, the cooling capacity of the second refrigeration unit is never exceeded, as the change in temperature of the potable liquid during high demand is kept as low as possible due to the operation of the first cooling unit.

The ring main includes an adjustable fluid flow control device 7. The temperature of the beverage is regulated by varying the rate of flow of the beverage through the cooling unit 6. The fluid flow control device 7 comprises a restriction 10 which, according to an embodiment, is arranged to allow continuous restricted circulation of beverage around the ring main. The fluid flow control device also comprises an on/off valve which is responsive to a temperature sensor 12. The on/off valve 11 upon actuation by the temperature sensor allows unrestricted flow of the beverage around the ring main.

20

The temperature sensor 12, restriction 10 and the on/off valve 11 co-operate to regulate the temperature of the beverage taking into account the rate of transfer of heat between the beverage and the refrigerant of the cooling unit which includes the temperature gradient between the beverage and the refrigerant, the rate of flow of the beverage, and hence the duration for which a

25

given quantity of beverage is contained within the cooling unit 6, and the capacity or volume of the tubes 4 of the ring main contained within the cooling unit 6.

5 The regulation of the temperature of the beverage is also responsive to actuation of the dispense taps 9. Demand for beverage should be balanced against the temperature of the potable liquid. An embodiment can be realised in which the on/off valve is also made
10 responsive to actuation or opening of a dispense tap to open the on/off valve and allow flow of potable liquid therethrough. In the event of conflicting commands being imposed upon the on/off valve, the open command in response to the dispense tap is typically arranged to
15 take priority.

Referring to figure 4 there is shown an embodiment for regulating the temperature of a plurality of potable liquids. The beverages are stored in respective storage
20 containers 1a, 1b, 1c and 1d and circulate around and are dispensed from respective ring mains in a manner substantially as described above in relation to figure 3. The pump 5 is a commonly driven electrical multi-headed pump.

25

Figure 5 illustrates an arrangement whereby the tubes 4 of the embodiment of figure 4 carrying the

potable liquid are contained within a housing 13 or protective conduit. The tubes 4 are lagged or thermally insulated according to the environment with a suitable insulation material 14. The housing has a dual purpose.

5 Firstly, the housing 13 protects the pipes against attack by pests and vermin. Secondly, the combination of the insulation 14 and the housing 13 prevent or reduce the formation of condensation on the tubes 4 carrying the potable liquid.

10

An alternative form of protecting the tubes 4 and preventing the formation of condensation thereon is shown in figure 6. The tubes 4 together with associated insulation 14 are housed within a flexible conduit 15.

15 The flexible conduit 15 is used to accommodate changes in direction of the tubes 4 between the bulk storage and the point of dispense.

Referring to figure 7, there is shown an embodiment

20 of the present invention wherein the two cooling units 6 depicted in figures 3 and 4 are combined into a single unit cooling unit 16. The potable liquid passes through the cooling unit 16 twice.

25 The advantage of the embodiment depicted in figure 7 is particularly suitable for retro-fitting within existing liquid refrigeration and dispense installations.

The flow control device and temperature sensors are also utilised notwithstanding their absence from figure 7. The potable liquid comes from bulk storage and enters the cooling unit 16 from the right-hand side via tubes 2.

5 The potable liquid is firstly cooled by the cooling unit 16 before circulation around the dispensing main or before dispense from the flow and return arrangement shown in figures 1 and 2. The cooled potable liquid leaves the cooling unit via those tubes 4 in

10 communication with the pump 5 at the bottom of figure 7.

The combination of the temperature sensor and fluid flow control means is operable to vary the speed and manner of flow of the potable liquid, that is to say, the

15 rate of flow of liquid can be increased, decreased, stopped and/or started or pulsated

Once the potable liquid reaches the pump 5 it is circulated around the ring main or flow and return tubes

20 to which the dispense taps (not shown) are connected. The potable liquid is maintained at the desired temperature in a manner substantially as described above in relation to figures 1, 2, 3 and 4. The potable liquid is then fed back to the pump 5 for further circulation.

25

It will be appreciated that the potable liquid is maintained at a preferred serving temperature without

having to return the liquid to bulk storage which overcomes the limitations and illegalities of some prior art systems.

5 The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and
10 documents are incorporated herein by reference.

All of the features disclosed in this specification
(including any accompanying claims, abstract and drawings), and/or all of the steps of any method or
15 process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification
20 (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example
25 only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiments. The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any
5 accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. A potable liquid temperature regulating apparatus
suitable for use in beverage dispensing systems
5 wherein the potable liquid is brought into contact
with a liquid temperature regulating means
independently of the dispensing means.
2. A potable liquid temperature regulating apparatus
10 according to claim 1, which comprises a potable
liquid re-circulation circuit incorporating a
potable liquid temperature regulating means.
3. A potable liquid temperature regulating apparatus
15 according to claim 1 or 2, which comprises a liquid
storage means and a dispensing means which
comprises:
 - (i) a liquid dispense tube, pipe or line extending
20 from the liquid storage means to the dispensing
means;
 - (ii) a liquid temperature regulating means; and
 - (iii) means for circulating the potable liquid in the
liquid dispense tube, pipe or line
independently of the dispensing means into
25 contact with the liquid temperature regulating
means.

4. A potable liquid temperature regulating apparatus according to any of the preceding claims, wherein the liquid dispense tube, pipe or line comprises two tubes, pipes or lines located within an outer insulated jacket.
- 5
5. A potable liquid temperature regulating apparatus according to claim 4, in which the two tubes are connected at their ends so that they run in parallel for at least a part of the tube, pipe or line extending from the liquid storage means to the liquid dispensing means.
- 10
6. A potable liquid temperature regulating apparatus according to any of the preceding claims, in which the liquid temperature regulating means comprises a cooler having a plurality of cooling compartments arranged at different temperatures, or a cooler having a single cooling compartment having a temperature gradient.
- 15
- 20
7. A potable liquid temperature regulating apparatus according to any of the preceding claims, in which the means for circulating the liquid independently of the dispensing means comprises a pump in communication with the liquid dispense tube, pipe or line in order to circulate the liquid into contact
- 25

with the liquid temperature regulating means independently of the operation or opening of the dispensing means.

- 5 8. A potable liquid temperature regulating apparatus according to claim 7, in which a portion of the liquid dispense tube, pipe or line comprises a loop of two tubes pipes or lines, one acting as a flow and the other as a return, such that, when the
10 dispensing means is closed, the liquid is circulated around the loop by the pump means, and into contact with the liquid temperature regulating means.
- 15 9. A potable liquid temperature regulating apparatus according to claim 7 or 8, wherein means are provided for over-riding the action of the pump means when liquid is dispensed from the liquid dispense means.
- 20 10. A potable liquid temperature regulating apparatus according to any of claims 2 to 9, wherein fluid flow control means are provided to control the liquid flow rate of the circulating liquid.
- 25 11. A potable liquid temperature regulating apparatus according to claim 10, wherein the fluid control means comprises at least one of either a restriction

or slip allowing flow of the potable liquid at a predeterminable rate restricted relative to the flow capacity of the tubes or an on/off valve for allowing or preventing flow of the potable liquid.

5

12. A potable liquid temperature regulating apparatus according to any preceding claim, further comprising a temperature sensor and wherein the fluid control means is responsive to a predeterminable signal from the temperature sensor to vary the rate of flow of the potable liquid.

10

13. A potable liquid temperature regulating apparatus according to any of claims 10 to 12, wherein the fluid control means is responsive to an actuation, such as opening, of a dispense means or tap.

15

14. A potable liquid temperature regulating apparatus according to claim 13, wherein the on/off valve is responsive to the actuation of the dispense means.

20

15. A potable liquid temperature regulating apparatus according to claim 14, wherein the responsiveness of the on/off valve to the actuation of the dispense means takes priority over any conflicting operation of or command given to the on/off valve.

25

16. A potable liquid temperature regulating apparatus as claimed in any preceding claim wherein the path of the potable liquid is arranged to come into contact with the liquid temperature regulating means twice.
- 5
17. A potable liquid temperature regulating apparatus as claimed in any preceding claim, wherein the potable liquid is brought into contact with the liquid temperature regulating means without being returned
- 10 to bulk of the potable liquid.
18. A potable liquid temperature regulating apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying
- 15 Drawings.
19. A potable liquid temperature regulating apparatus substantially as hereinbefore described.
- 20 20. A beverage dispensing device comprising a liquid temperature control apparatus according to any of claims 1. to 19 and/or wherein said apparatus is arranged to provide a ring main and a plurality of dispensing taps.
- 25
21. A method of regulating the temperature of a potable liquid to be dispensed which comprises circulating

the liquid into contact with a liquid temperature regulating means independently of the dispensing means.

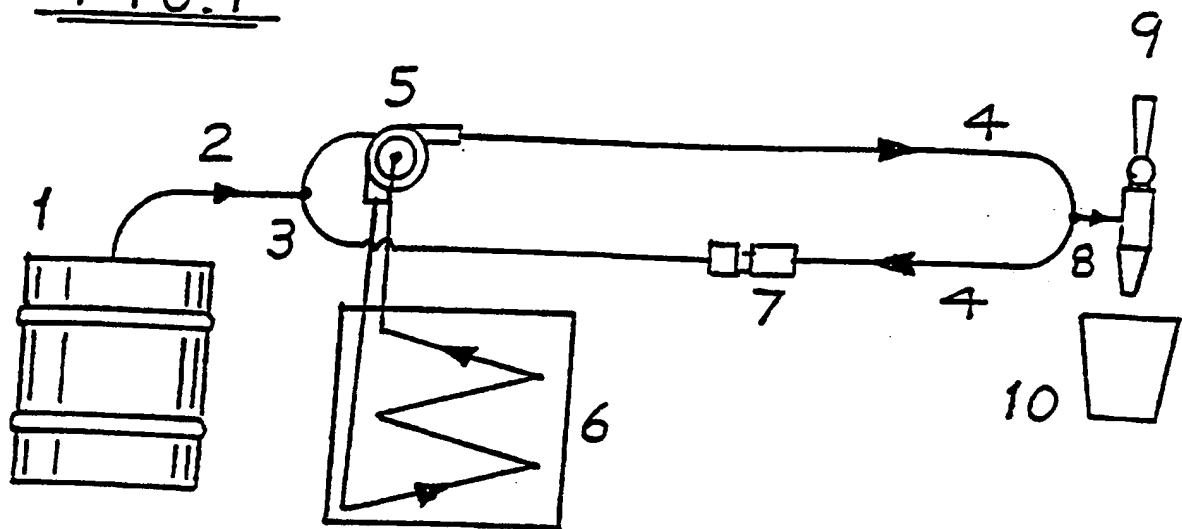
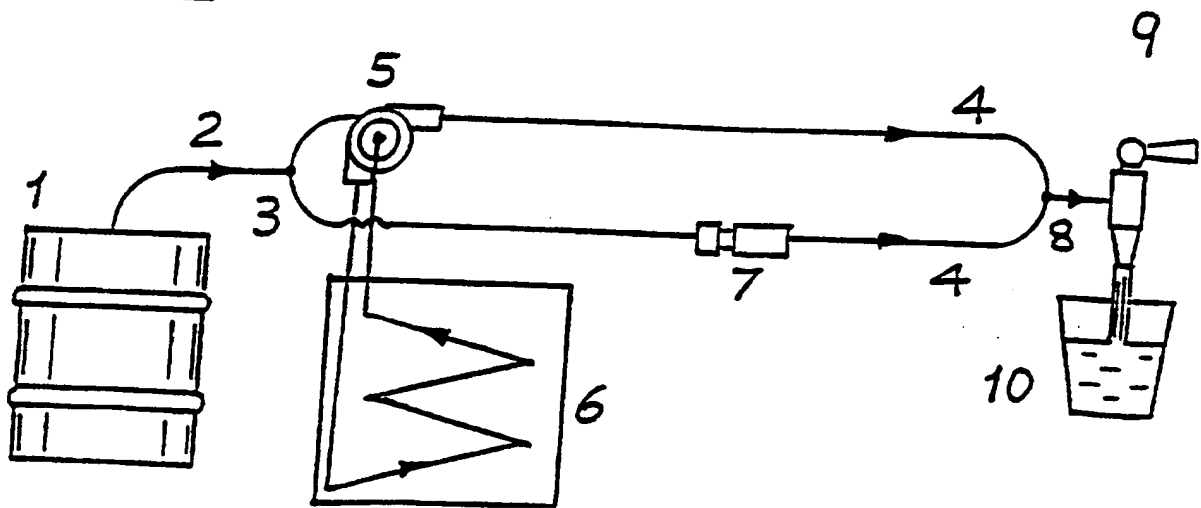
- 5 22. A method of regulating the temperature of a potable liquid comprising circulating the potable liquid into contact with the liquid temperature regulating means without returning the potable liquid to bulk storage of the potable liquid.

10

23. A method according to claim 21 or 22 wherein the temperature of the liquid is at or below ambient temperature.

- 15 24. A method according to either of claims 21 or 23 wherein there is used an apparatus according to any of claims 1 to 20.

- 20 25. A method of dispensing a potable liquid at a pre-determined temperature substantially as hereinbefore described.

FIG.1FIG.2

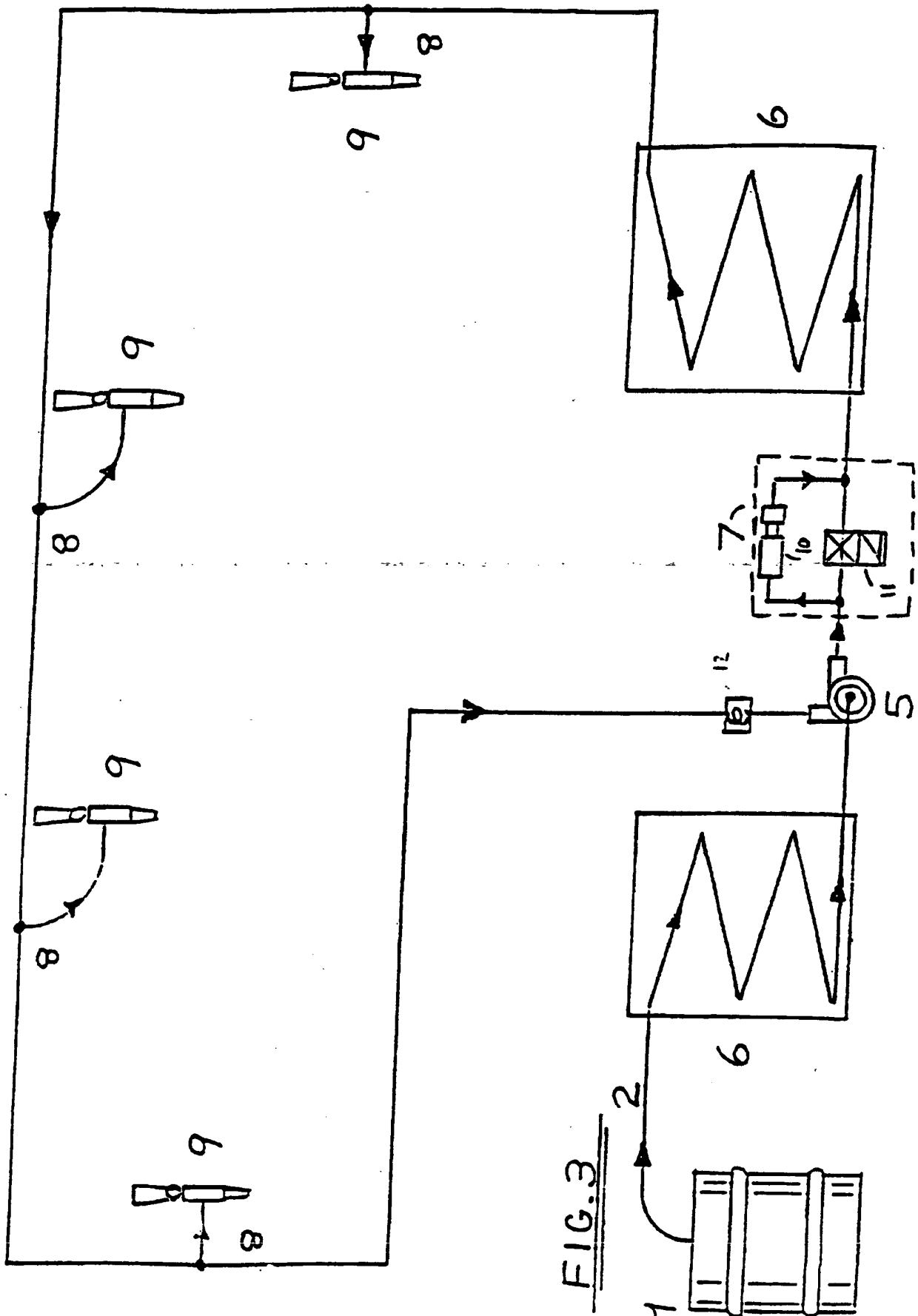


FIG. 3

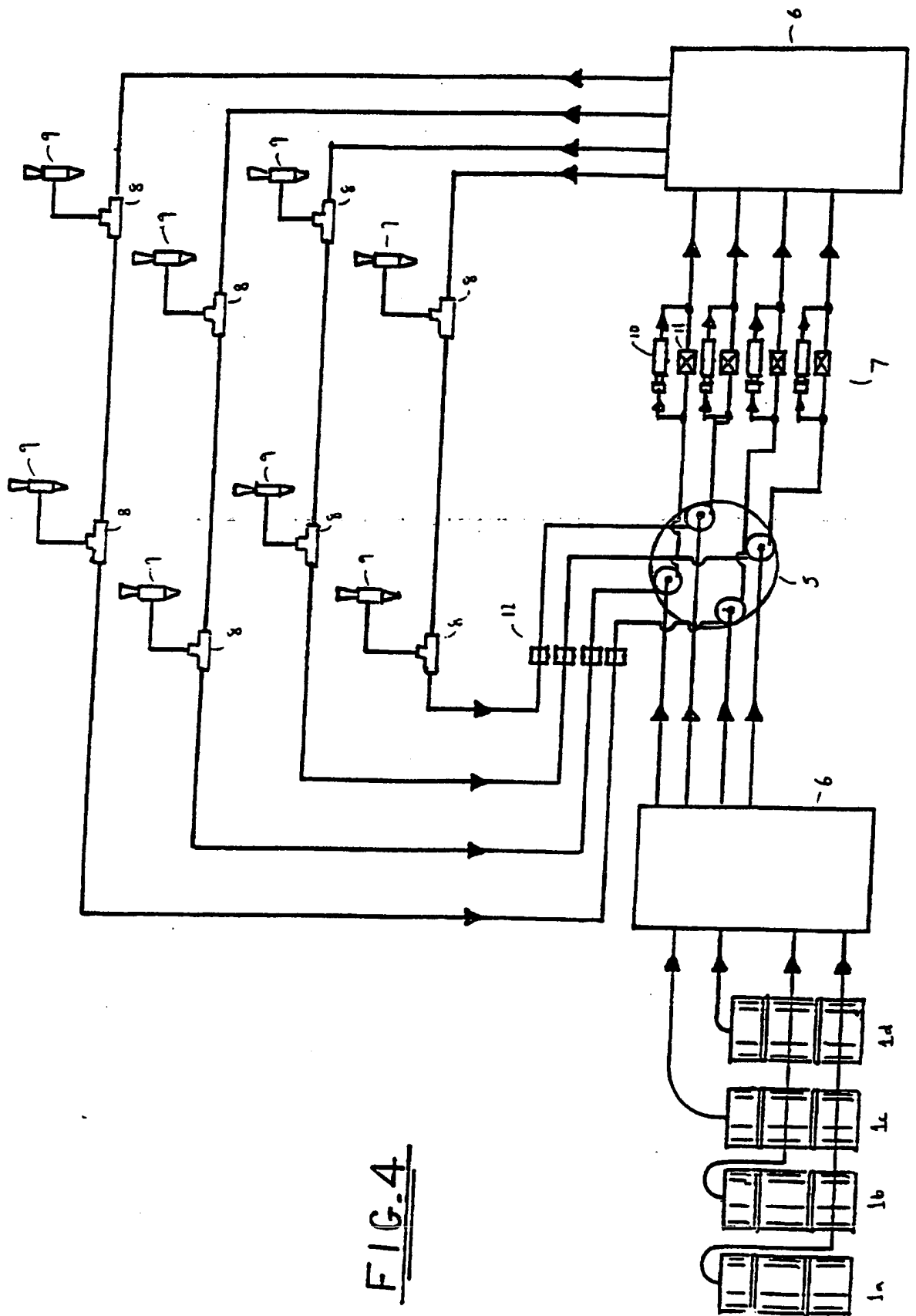


FIG. 4

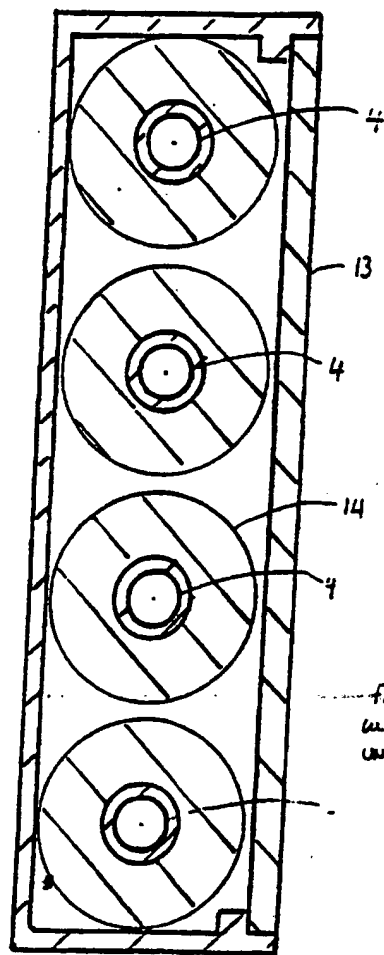


FIG. 5

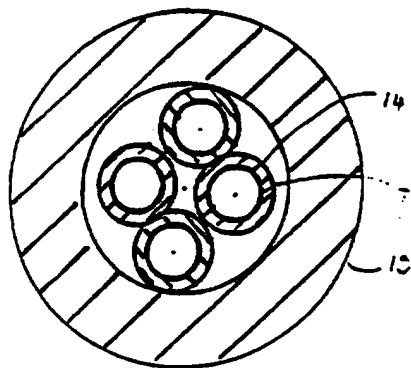


FIG. 6

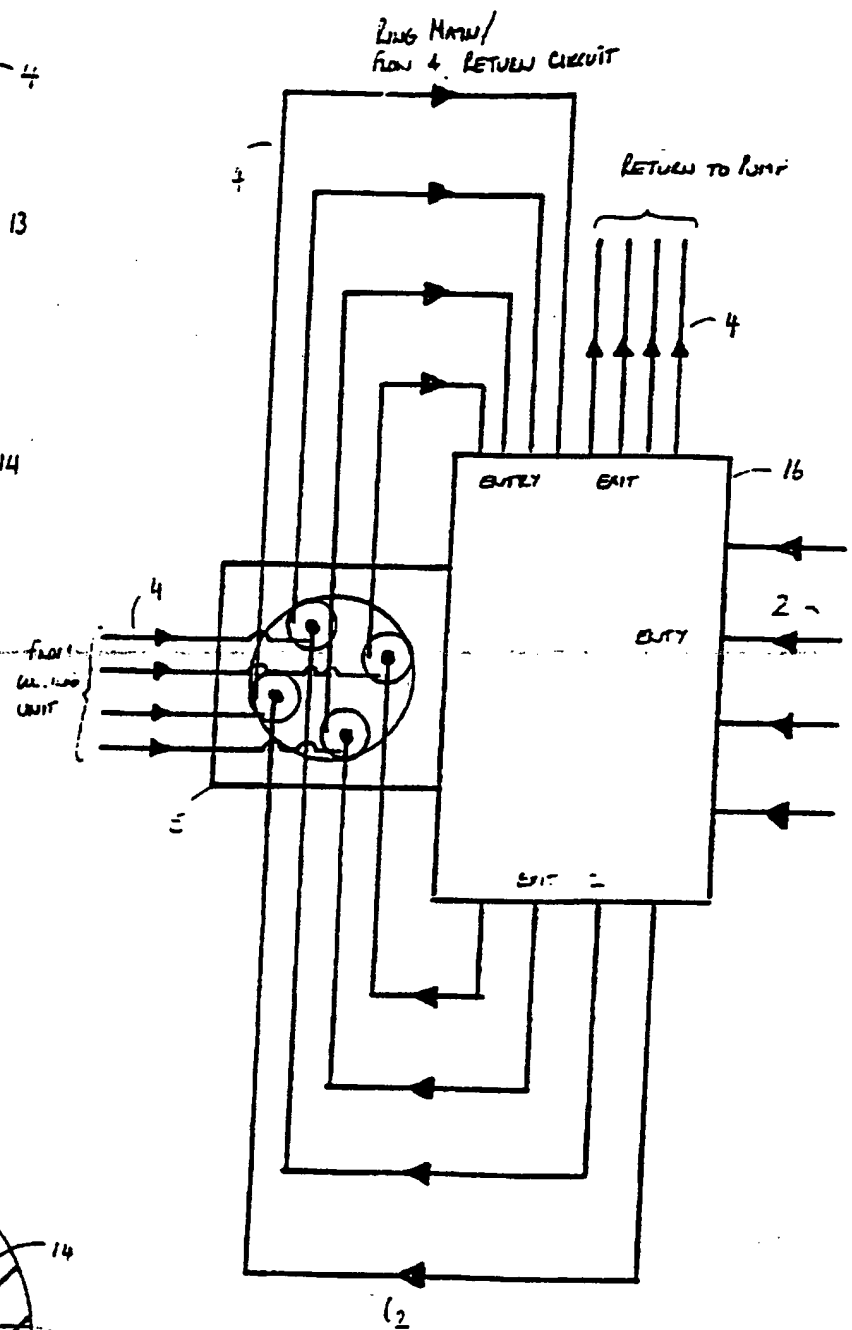


FIG. 7

INTERNATIONAL SEARCH REPORT

Int'l Application No

PCT/GB 97/00288

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B67D1/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B67D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 216 879 A (J. MCMILLIN) 12 August 1980 see column 2, line 64 - column 6, line 11 see figure	1-3, 7-11,13, 14,16, 17,20-24
X	EP 0 152 283 A (R. DIXON ET AL.) 21 August 1985 see page 6, line 20 - page 7, line 34 see figure 2	1-5,7,8, 10,11, 20,21, 23,24
X	GB 2 232 400 A (UNIVERSAL EQUIPMENT CO.) 12 December 1990 see page 5, line 1 - page 6, line 19 see figure	1-3,7,8, 17,21-24
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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Date of the actual completion of the international search

4 June 1997

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

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PCT/GB 97/00288

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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